General Relativity, String Theory and the Super-Universe

Abstract:

This paper forms the foundations of a new theory of time, gravity and the infinite Universe. In Part 1 I expose a mistake in the theory of General Relativity and then proceed to develop new field equations for gravitational time dilation. The idea is that Einstein achieved the correct results with incorrect working. In Part 2 I propose a physical model of gravity based on a network of strings. In Part 3 I propose an explanation for the big bang and probably the only working model of the infinite Universe. This is the first real challenge to Einstein in a century.

Part 1: Gravitational Time Dilation

Introduction:

According to Einstein's theory of General Relativity

"in every gravitational field, a clock will go more quickly or less quickly, according to the position in which the clock is situated (at rest)."[1]

If one clock is situated in a stronger gravitational field and another in a weaker gravitational field, the clock in the weaker gravitational field goes at a rate permanently faster than the clock in the stronger gravitational field.

Furthermore, Einstein predicted the effect of gravitational red shift when the light measured comes from an object with a stronger gravitational field, Einstein proposed the testing of this effect as an experimental proof of the theory of General Relativity. In the words of Einstein

"a displacement towards the red ought to take place for spectral lines produced at the surface of stars as compared with the spectral lines of the same element produced at the surface of the earth."[1]

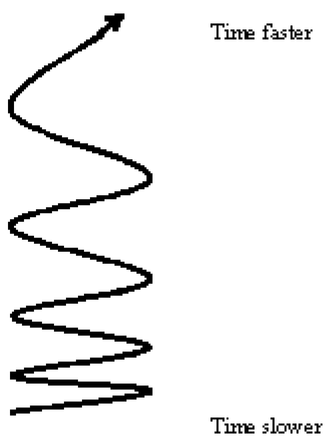
I propose that although Einstein was correct in his prediction, there is another explanation that would result in the exact same experimental results. My proposition is that Einstein achieved the proper results, with improper working. The alternate explanation contradicts one of the theory of Relativity's two postulates, that the speed of light in a vacuum is the same in all inertial reference frames and is independent of the motion of the source. Following from this I propose that although the speed of light in a vacuum appears constant for all observers in all inertial reference frames, it may not actually be constant.

Part 1a: The Hypothesis

I outline below the effects of gravitational red shift as mentioned above and draw a diagram of these two confirmed proposals from the theory of General Relativity. [Figure 1]

Figure 1 –

Light losing energy due to gravity



An alternate explanation for these two experimental results becomes apparent from visualising the situation. One should consider the possibility that instead of moving at a constant velocity, light accelerates as it leaves a stronger gravitational field and enters a weaker gravitational field, proportional with an increase in the rate at which time advances.

Thus I have developed a new definition of time, I will introduce a concept "the speed of time" (sot), where the sot is the ratio of the time at a certain location and/or velocity to the time as measured by someone in a fixed location and/or velocity. The easiest method is if the sot is measured in the S.I. units of seconds/earth seconds (s/s_E), where an earth second could be a second as measured at a particular location on the earth, like sea level at the equator or the Greenwich observatory. The sot on earth would therefore be equal to 1, while in regions where time is faster the sot is greater than 1 and where time is slower the sot is less than 1.

It is worthwhile to consider that if time is faster not only do clocks move faster, but chemical reactions happen faster, flora and fauna age faster, our brains work faster, so is it not possible that light also moves faster? According to the aforementioned, any increase in the speed of light in a vacuum would be unnoticeable because the timing mechanism that is used to measure the speed of light would also move faster. If the sot was greater, or "faster," in a particular region, then a second (for example) would become shorter and therefore light would have to travel faster in that shorter second to cover the same distance as it would cover in a longer second (where the sot is less).

Thus by this definition of time the speed of light in a vacuum can appear to remain constant when the speed of light in a vacuum is not actually constant at all. However there is one way that a change in the speed of light is noticed, by the red/blue shift that accompanies this change in the speed of light. The hypothesis is that while frequency appears to change, this is only because our measure of time has changed. The frequency, and therefore the energy of light remains constant, however the wavelength has changed. By this theory's definition of time, if time is faster then everything moves faster, including our clocks and including light.

In the course of this paper, and my theory as a whole, I will examine some of the implications of this new interpretation of some old experimental results and develop a new theory of time and gravity from first principles.

Part 1b: The Basic Equations

Let's begin by introducing another new definition, "the speed of light as measured from the perspective of someone on earth," and give it the value c_E measured in the S.I. units of metres/earth second, or m/s_E. The energy of light is given by the relation

$$E = h\upsilon_E$$

(1)

(Where E = energy, h = Planck's constant, υ_E = frequency from the perspective of an observer on earth.)

If we assume by the first law of thermodynamics that energy is conserved, and if we also assume that frequency remains constant from the perspective of someone on earth, then we must first check that the units of measurement are balanced, so we will now consider the S.I. units of measurement with regards to this equation.

$$E\ (kgm^2s_E^{-2}) = h(kgm^2s_E^{-1})\upsilon_E(s_E^{-1})$$

(2)

If we study equation (2) we notice that the value for frequency 'υ_E' must change if time changes, so let's think about this carefully, the units for frequency aren't really '$1/s_E$' but 'waves/s_E' and if we take this into consideration while assuming that the number of waves per second does not change, then the equation makes more sense. We could talk about the number of "earth waves" and consider them to change in proportion to earth seconds, however a wave is a wave regardless of what your measure of time, an “earth wave” is no different to simply a “wave”.

$$E\ (kgm^2 s_E^{-2}) = h(kgm^2 s_E^{-1} wave^{-1}) v_E (waves.s_E^{-1})$$

(3)

Now we can consider the Planck constant to be a constant per wave, so it does not change with time but remains a constant independent of the sot. However it must be noticed that the units on the left hand side of equation (3) are not balanced, if ‘s_E’ changes then the energy must also change, unless we introduce terms for either ‘kg_E’ or ‘m_E’, which are kilograms as measured from the perspective of someone on earth and metres as measured from the perspective of someone on earth respectively. Now we know that either mass or distance must also change when time changes. Next let’s consider Einstein’s most famous equation but with the introduced term the speed of light as measured from the perspective of some on earth ‘c_E’ while keeping the units in mind and remembering the first law of thermodynamics, the law of the conservation of energy

$$E(kgm^2 s_E^{-2}) = m(kg) c_E^2 (m^2 s_E^{-2})$$

(4)

(Where c_E = the speed of light from the perspective of an observer on earth, m = mass.)

Now we understand that mass from the perspective of someone on earth must change in proportion to time from the perspective of someone on earth squared. In other words, when time becomes faster mass decreases, from the perspective of someone on earth of course. Let’s rewrite equation (4) now

$$E(kg_E m^2 s_E^{-2}) = m_E(kg_E) c_E^2 (m^2 s_E^{-2})$$

(5)

Ignoring the units now equation (1) is simply the same

$$E = hv_E$$

(1)

While rewriting equation (5) without the units is simply

$$E = m_E c_E^2$$

(6)

It must be kept in mind that energy is always conserved, that energy remains constant no matter what the change in the sot, according to this theory energy only ever appears to change due to changes in the measurement of time.

Now we must consider the equation for kinetic energy

$$E = \frac{1}{2} m_E v_E^2$$

(7)

(Where v_E = velocity from the perspective of an observer on earth.)

According to the above hypothesis, if mass decreases in weaker gravitational fields (for example) velocity squared must increase proportionally. Now we can understand mathematically the reason why when time is faster everything moves more easily through space. In weaker gravitational fields not only does light move faster, but so too do objects of mass. Objects of mass must move faster in weaker gravitational fields because their mass decreases while their kinetic energy remains constant thus resulting in an increased velocity, from the perspective of someone on earth of course.

The next equation to consider is the simplified equation for gravitational potential energy

$$E = m_E g_E h$$

(8)

(Where g_E = gravitational acceleration from the perspective of an observer on earth.)

According to this equation, if mass 'm_E' decreases then gravitational acceleration 'g_E' must increase proportionally. Now let's consider the proper equation for gravitational acceleration, recall that if mass decreases the sot increases and gravitational acceleration increases

$$g_E = \frac{MG_E}{r^2}$$

(9)

(Where G_E = the universal gravitation constant from the perspective of an observer on earth, r = the distance from the centre of mass (or the radius), M = the mass of the object creating the gravity in question.)

Now we must conclude that if the mass of an object subject to gravitational acceleration decreases the value for the gravitational constant 'G_E' must increase proportionally. Consider next the S.I. units

$$g_E(ms_E^{-2}) = \frac{M(kg)G_E(m^3kg^{-1}s_E^{-2})}{r^2(m^2)}$$

We can see that the value for the gravitational constant changes depending on the strength of the gravitational field an object subject to gravity is in, or if you prefer, the value of the gravitational coefficient changes depending on the sot in that location in space. I propose changing the name of the gravitational constant to the 'gravitational coefficient'.

Let's stop for a moment and think about the equations we have been discussing and their full implications. I have now developed a series of equations from the reinterpretation of one single experiment. What we've learned is that mass decreases in weaker gravitational fields, the combination of this decrease in mass and the conservation of energy results in an increase in the velocity of matter and energy, and an increase in the gravitational acceleration of matter. What we've learned is that in weaker gravitational fields, when time is faster, everything moves faster. While it may seem counter-intuitive that light would accelerate due to gravity, rather than decelerate, it is important to recall another of Einstein's equations

$$E = p_E c_E$$

(10)

(Where p_E = momentum from the perspective of an observer on earth.)

According to this equation, if gravitational field strength decreases, time becomes faster and light accelerates, then the momentum of light must decrease proportionally to any increase in the speed of light. So while light may not slow due to gravity, and it is actually the opposite that occurs, gravity affects the momentum of light. It makes sense now that since gravity changes the momentum of light that the path of light can be bent by gravity, as predicted by Einstein.

Consider now what the implications of assuming light speed to be constant might be, for example, we use electromagnetic radiation (emr) to measure distances within the solar system. If this hypothesis is correct our measurements of the solar system must be very slightly incorrect, as emr moves away from the sun time must become faster, emr must accelerate, and the outer planets must be further away and moving faster than what is presently believed. If this hypothesis is correct, the size of the solar system could be an optical illusion. Of course, were you to send a spacecraft to a planet on the outskirts of the solar system as time becomes faster that spacecraft would also accelerate, just the same way that light would. We could never know that our measurements are an illusion unless we could observe gravitational motion in its entirety, from outside a gravitational field, not from within it. The true extent of this effect within our solar system is difficult to calculate, for reasons which will become clearer shortly, but I am certain that it can be calculated.

Think now about stars on the outskirts of galaxies, stars on the outskirts of galaxies have been found to be moving faster than predicted by the theories of Newton and Einstein, the most popular explanation for observed galactic rotation curves is that there must be a large amount of unseen matter in galaxies, it is known as the theoretical dark matter. However if my theory is correct it may be that dark matter is unnecessary and that galaxy rotation curves can be explained by a new understanding of exactly how gravity works.

Part 1c: Gravitational Time Dilation and Dark Matter

According to my theory mass varies as a function of gravitational field strength which creates a change in time due to conservation of kinetic energy and gravitational potential energy.

The scalar equation for gravitational field strength is

$$g = -\frac{GM}{r^2}$$

Now we wish to consider changes in the mass of an object in a particular gravitational field 'm_r' with respect to mass as experienced on Earth 'm_E'. We also need to consider that mass will reach a minimum at a theoretical infinite distance from the gravitational field it is a part of. However it becomes difficult because everything is a part of a different gravitational field. Although the speed of time on Earth would be equal to 1, Earth is primarily a part of the gravitational field of the Sun, so at a theoretical infinite distance from the Earth $m_\infty/m_E < 1$ or $t_\infty/t_E < 1$ or $\Delta t_\infty/\Delta t_E > 1$ and is dependent on the gravitational field strength of the Sun. The Sun in turn is primarily a part of the gravitational field of the Milky Way, and the Milky Way a part of the local universe around it.

When discussing changes in time it is important to remember that when time is faster a second becomes shorter, so the "length" or "size" of an earth second decreases. This means that more seconds pass relative to an earth second, thus it is easier to think in terms of changes in time, how much time has passed for an object in comparison to how much time has passed on earth. This way when time is faster the ratio $\Delta t_r/\Delta t_E$ is greater and vice versa when time is slower, this ratio is the inverse of t_∞/t_E.

To determine the change in the mass of an object as a function of distance from the centre of mass of an object we can thus write the equation

$$\frac{d(m_r/m_E)}{dr} = -\frac{\alpha GM}{r^2} \times \frac{m_\infty}{m_E}$$

Where 'α' is a constant. The term 'm_∞/m_E' is introduced because the formula calculates the deviation from the minimum possible mass at a theoretical infinite distance. Now integrating we have

$$\frac{m_r}{m_E} = \frac{\alpha GM}{r} \times \frac{m_\infty}{m_E} + b$$

Where ‘b’ is a constant, and since as r → ∞ the value for $m_r/m_E \rightarrow m_\infty/m_E$ and then the constant must be m_∞/m_E and therefore the equation for mass dilation due to gravity is

$$\frac{m_r}{m_E} = \frac{\alpha GM}{r} \times \frac{m_\infty}{m_E} + \frac{m_\infty}{m_E}$$

Or

$$\frac{m_r}{m_E} = \frac{m_\infty}{m_E}\left(\frac{\alpha GM}{r} + 1\right)$$

Recall that mass dilation is proportional to the time dilation squared (from equations for the conservation of energy) or inversely proportional to the speed of time squared so

$$\frac{\Delta t_E}{\Delta t_r} = \frac{\Delta t_E}{\Delta t_\infty}\sqrt{\frac{\alpha GM}{r} + 1}$$

Or

$$\frac{\Delta t_r}{\Delta t_E} = \frac{\Delta t_\infty / \Delta t_E}{\sqrt{\frac{\alpha GM}{r} + 1}}$$

Compare to Einstein’s equation for time dilation due to gravity

$$t_0 = t_f\sqrt{1 - \frac{2GM}{rc^2}}$$

(11)

(Where t_0 = slower time, t_f = faster time, other values as before.)

The above equations describe how mass and time dilate as a function of distance ‘r’ from an object of mass ‘M’ approaching a limit at a theoretical infinite distance from said object of mass. Due to the similarity to Einstein’s equation for time dilation due to gravity it is safe to assume that the value for the constant ‘α’ is equal to $2/c^2$ thus my equations are complete.

$$\frac{m_r}{m_E} = \frac{m_\infty}{m_E}\left(\frac{2GM}{rc^2} + 1\right)$$

(12)

$$\frac{\Delta t_r}{\Delta t_E} = \frac{\Delta t_\infty / \Delta t_E}{\sqrt{\frac{2GM}{rc^2} + 1}}$$

(13)

It is important to test different scenarios with regards to equations (12) and (13) to ensure their success.

When r → ∞ (12) becomes

$$\frac{m_r}{m_E} \rightarrow \frac{m_\infty}{m_E}$$

When r → ∞ (13) becomes

$$\frac{\Delta t_r}{\Delta t_E} \to \frac{\Delta t_\infty}{\Delta t_E}$$

When r → 0 (12) becomes

$$\frac{m_r}{m_E} \to \infty$$

When r → 0 (13) becomes

$$\frac{\Delta t_r}{\Delta t_E} \to 0$$

Equations (12) and (13) bring to light Einstein's oversight in developing his equation for time dilation due to gravity. Einstein failed to take into consideration that the limit for gravitational field strength depends on the greater gravitational field of which the object in question is a part. While Einstein's equation for time dilation due to gravity would work well on Earth it would not work when studying galaxies, for example, because the time dilation within a galaxy would depend on the strength of the gravitational field of which that galaxy is a part. That's the complicated reason that Einstein's equation for time dilation due to gravity does not work, the simple reason is that Einstein's function describing time dilation should have the range $0 < \Delta t_0/\Delta t_f < \infty$ and as such his function cannot possibly be correct, since it is not continuous. Please note that while my theory says that neither 'c^2' nor 'G' are constant in different gravitational fields, 'c^2' varies proportionally to 'G' so for simplicity in this situation they may be assumed to be constant.

Notice that equations (12) and (13) do not collapse within the Schwarzschild radius, as radius 'r' approaches zero, mass (from the perspective of someone on earth) becomes infinite and time becomes infinitely slow. This idea has huge implications for "black holes" because it means that the laws of physics do not collapse but it is only Einstein's equations which collapse. However I will talk more about black holes in Part 3.

Modified Newtonian dynamics (MOND) has attempted to explain dark matter by tweaking Newton's equations for gravity on the outskirts of galaxies. The creator of MOND, Mordehai Milgrom, proposes that gravity behaves differently when gravitational acceleration becomes very small. He has found that when studying galaxies, if centripetal gravitational acceleration varied as a function of radius 'r' rather than the square of the radius 'r^2' then the velocities of stars on the outskirts of galaxies could be explained without the need for the theoretical dark matter.[2] Let's now examine how my equations would behave when studying gravitational acceleration within a galaxy.

$$g = \frac{GM}{r^2}$$

Recall

$$G \propto \frac{1}{m_r/m_E}$$

And equation (12)

$$\frac{m_r}{m_E} = \frac{m_\infty}{m_E}\left(\frac{2GM}{rc^2} + 1\right)$$

$$\frac{m_E}{m_r} = \frac{m_E/m_\infty}{\left(\frac{2GM}{rc^2} + 1\right)}$$

Now we have

$$g = \frac{m_E}{m_\infty}\left(\frac{GM}{\left(\frac{2GM}{rc^2}+1\right)r^2}\right)$$

As r becomes relatively small, as compared to a very large mass, the equation becomes

$$g = \frac{m_E}{m_\infty}\left(\frac{c^2}{2r}\right)$$

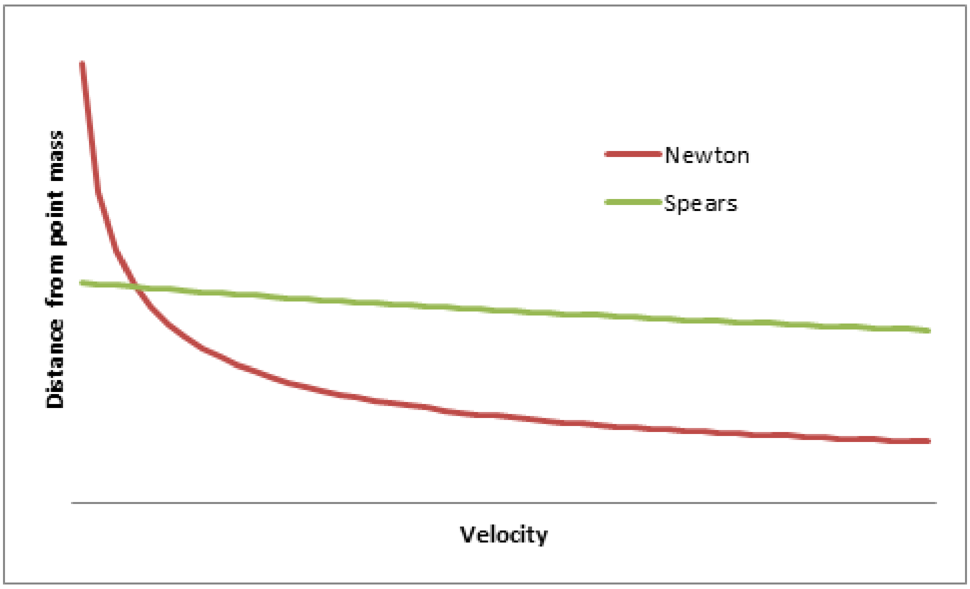
Although without the changes in the gravitational constant balancing the changes in the speed of light, gravitational acceleration would change with the change in the speed of light, so really we should rewrite this as

$$g = \frac{m_E}{m_\infty}\left(\frac{c_r^2}{2r}\right)$$

(14)

As all other terms are constant as r becomes relatively small centripetal gravitational acceleration varies as a function of radius 'r' rather than radius squared 'r^2' at a relatively small distance from the centre of a very large mass, just as explained in the empirically based MOND theory.

Let's do a plot of rotational velocities around a point mass, with m_E/m_∞ given a value of 10.



The above plot is very interesting with regards to the search for dark matter. We can see that for large mass, by my theory, we have essentially a linear relationship between distance 'r' and the rotational velocity. My theory could be the explanation that we have been searching for. The position where the lines intersect is the location where the sot in my equation is the same as it is on earth, i.e. $\Delta t_r/\Delta t_E = 1$. Although the trends shown on the above plot are very interesting, further investigation on the subject of dark matter is required.

My hypothesis, in addition to the possible explanation for dark matter, would also logically explain the observed acceleration of the universe as it expands. According to my theory, as the universe expands the gravitational field strength within the universe would decrease and therefore time would become faster. As the universe expands and time becomes faster within the universe, not only would the expansion of the universe accelerate, but the wavelength of light travelling from distant galaxies would shift further towards the red as the sot increases while this light is in transit. The mysterious expanding force acting on the universe, which has become known as "dark energy," could be easily explained by gravitational time dilation. I will discuss the expansion of the universe further in Part 3.

Part 1d: Partial Derivation Of The Gravitational Deflection Of Light

Since momentum is inversely proportional to the speed of light (10)

$$\frac{p_r}{p_E} = \frac{t_r}{t_E} \left(Note{:} \, This \; is \; not \; \frac{\Delta t_r}{\Delta t_E} \right)$$

$$\frac{p_r}{p_E} = \frac{p_\infty}{p_E} \sqrt{\frac{2GM}{rc^2} + 1}$$

$$p_r = p_\infty \sqrt{\frac{2GM}{rc^2} + 1}$$

Now

$$\frac{dp_r}{dr} = -\frac{p_\infty GM}{r^2 c^2 \sqrt{\frac{2GM}{rc^2} + 1}}$$

Since

$$\frac{dr}{dt_r} = c_r = \frac{c_\infty}{\sqrt{\frac{2GM}{rc^2} + 1}}$$

And

$$\frac{dp_r}{dr} \times \frac{dr}{dt_r} = \frac{dp_r}{dt_r}$$

Then

$$\frac{dp_r}{dt_r} = -\frac{p_\infty c_\infty GM}{r^2 c^2 \left(\frac{2GM}{rc^2} + 1 \right)}$$

Since

$$p_\infty c_\infty = p_r c_r = E$$

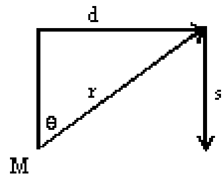
Therefore

$$\frac{d(1/c_r)}{dt_r} = -\frac{GM}{r^2 c^2 \left(\frac{2GM}{rc^2} + 1 \right)}$$

(15)

This value is analogous to acceleration, however since we know that light neither accelerates nor decelerates due to gravity but can only have its path bent, this value tells us how much the path of light is bent due to gravity. The value of this function is in the S.I. units of m^{-1} or (radians.m^{-1}) with respect to r. Notice also that this equation is equivalent to

$$\frac{d(1/c_r)}{dt_r} = -\frac{GM}{r^2c^2} \times \left(\frac{\Delta t_r}{\Delta t_\infty}\right)^2$$



Now 'r' is the distance from the centre of mass 'M', 's' is the distance along the light path, 'd' is the perpendicular distance from the centre of mass to the light path and 'Θ' is the angle from the origin at M. We need to change equation (15) to be in terms of 's' rather than 'r' and integrate over 's' for the entire path length. The angle of deflection of the light path will be given the symbol 'α'.

$$\alpha = -\int_{\theta=0}^{\theta=\pi} \frac{GM}{r^2c^2} \times \frac{1}{\left(\frac{2GM}{rc^2}+1\right)} \sin\theta \, ds$$

(16)

First let's explore the scenario where $(\Delta t_r/\Delta t_\infty)^2$ is close to enough to 1 as to be insignificant. In this case, close to earth, the equation becomes

$$\alpha = -\int_{\theta=0}^{\theta=\pi} \frac{GM}{r^2c^2} \sin\theta \, ds$$

Which becomes

$$\alpha = \int_{\theta=0}^{\theta=\pi} \frac{GM}{dc^2} \sin\theta \, d\theta$$

Which upon integration gives the solution

$$\alpha = \frac{2GM}{dc^2}$$

(17)

Which is identical to Einstein's original equation from 1911 for the gravitational deflection of light[2], however Einstein later updated this equation in 1915 after realising that this equation has assumed the value for 'd' to be constant. Einstein's final equation had increased the value for the deflection angle by a factor of 2.

Just quickly, integrating the full equation yields the rather complex

$$\alpha = \frac{1}{2}\left(\pi - \frac{c^2 d\pi}{\sqrt{c^4d^2 - 4G^2M^2}} + \frac{2c^2 d \tan^{-1}\left(\frac{2GM}{\sqrt{c^4d^2-4G^2M^2}}\right)}{\sqrt{c^4d^2-4G^2M^2}}\right)$$

(18)

Crunching the numbers for the two equations, using the deflection of a beam of light travelling around a point mass of one solar mass at a distance of one solar radius from the centre of mass gives, for equation (17) a value for the deflection angle of 0.875669arcseconds, while equation (18) gives a very slightly smaller value of 0.875666arcseconds. You might also notice that equation (18) collapses when the value for 'd' is inside the Schwarzschild radius, which should be expected since when a beam of light passes within the Schwarzschild radius it is believed to be sucked into the black hole, not merely have its angle deflected to a finite amount.

Although not a complete derivation, because I have assumed that the beam of light does not come any closer as a result of its gravitational deflection to the object of mass it is passing, the above should help to show that my theory should be able to account for everything that Einstein did if it is properly applied.

There are countless applications this theory could be applied to, with some degree of confidence we can now state that this theory should account for everything that was accounted for by Einstein. However a new variable has been added which only considerably impacts calculations for stellar bodies not relatively locally observed, such as calculations concerning the gravity of galaxies or black holes.

Part 2: Visualising Gravity In Four Dimensions

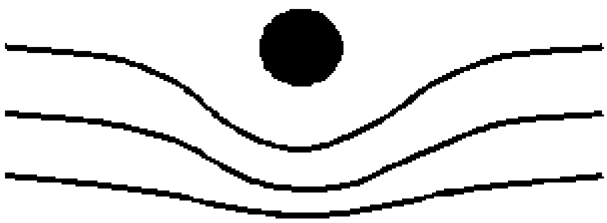
Part 2a: The Curvature Of Space

Einstein proposed that spacetime is warped by mass to create gravity, I shall expand on this idea below, however rather than refer to "spacetime" I shall refer simply to "space". Imagine the effect of an object of mass on a two-dimensional plane of space in one dimension, and let us draw a cross-section of said plane of space. Assume that space is repulsed by mass, or assume that mass repulses space, as first proposed by Einstein. [Figure 2a]

Figure 2a

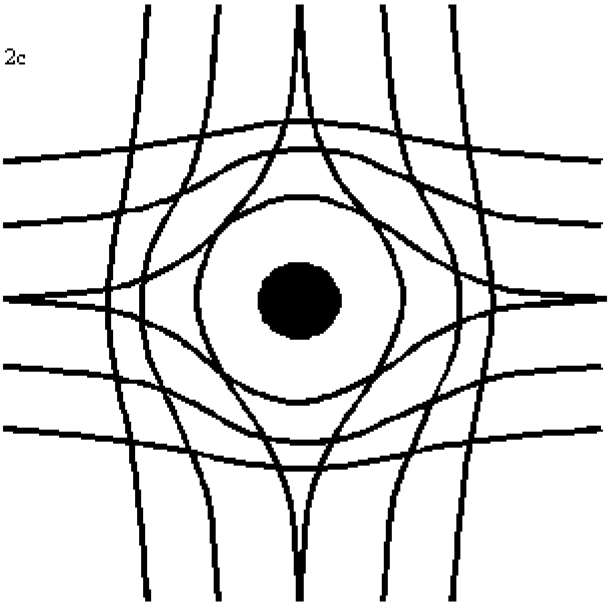
Of course, there wouldn't be just one plane of space in all of space, there should theoretically be an infinite number of these planes, so let's extend the idea. [Figure 2b]

Figure 2b



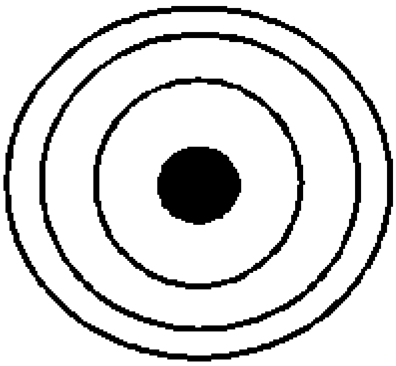
Next we must take into consideration that space is not one dimensional but three dimensional, so let's imagine space being repulsed by mass in every direction at once. [Figure 2c]

Figure 2c



Therefore the net effect of space being repulsed by mass in every direction at once would be something like this. [Figure 2d]

Figure 2d



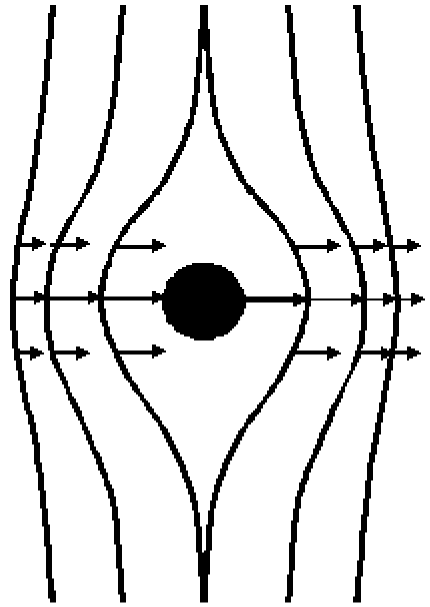
According to the above diagrams, the net effect of space being repulsed by mass in every direction at once would create something of a "density of space". In order for space to have a density there is no need to invent an æther to fill space, the curvature of space can create the effect of a density of space without the need for an æther to fill the voids.

Let's now expand on this idea of an infinite number of planes of space being repulsed by mass.

Part 2b: Space And Mass

Next we'll examine what would happen as an object of mass moves through space, let's visualise the situation. Although these theoretical planes of space themselves would not move, the curvature of space would be pushed forwards as an object of mass moves through space and space would be pushing the object of mass from behind. Since every action force has an equal and opposite reaction force, while mass pushes on space, space also pushes on mass. [Figure 3]

Figure 3



Therefore, when an object of mass is in motion space would essentially move with it. While it would take energy to set an object of mass in motion, due to the need to move the space with it, once that object of mass is in motion it would continue to move through space. An object of mass must push space forward to move through it, but space pushing the object of mass from behind ensures that the object continues to move forward and the law of inertia can thus be visualised. If space offered no resistance to the forward motion of mass then mass must always move at its maximum velocity, which we know to be light speed, having to set space in motion would require a specific amount of energy, the amount of energy required would be determined by how much space needs to be moved.

What is mass? We know from Part 1 that mass is not constant but is dependent on the gravitational field strength that mass resides in, from Part 2a we know that the gravitational field strength is determined by the density of space, and from above we know that the energy required to set an object in motion is determined by how much space needs to be "pushed out of the way". We could decide that mass is a measure of the effect an object has on the curvature of space. What is it about mass that causes space to warp? The traditional view is that space-time is repulsed by mass, but we also know that mass and energy are related, so perhaps we could take a new perspective and imagine that mass is the effect of an energy field that warps space. The greater the strength of this "mass energy" field, the greater the mass. In nuclear reactions "mass energy" could be converted to other forms of energy. The interchangeability of mass and energy was first proposed by Einstein with the equation $E=mc^2$ but now we can understand for the first time why mass is not entirely separate from energy, mass is simply the effect of an energy field that warps space and is itself a measure of the energy required to move an object through space.

If mass is a measure of the energy required to move an object through space, and the greater the mass the greater the "mass energy" field surrounding that object, then objects with greater "mass energy" fields surrounding them would require more energy to set planes of space in motion.

Why could an object of mass move faster through denser regions of space? Perhaps in regions of denser space the time taken for one plane of space to push on the next plane of space is reduced because the planes of space are closer together. Perhaps the transfer of energy from one plane of space to the next is limited to the maximum value of light speed, these planes of space can push on each other no faster than light speed, with light speed being dependent on how close together these planes of space are.

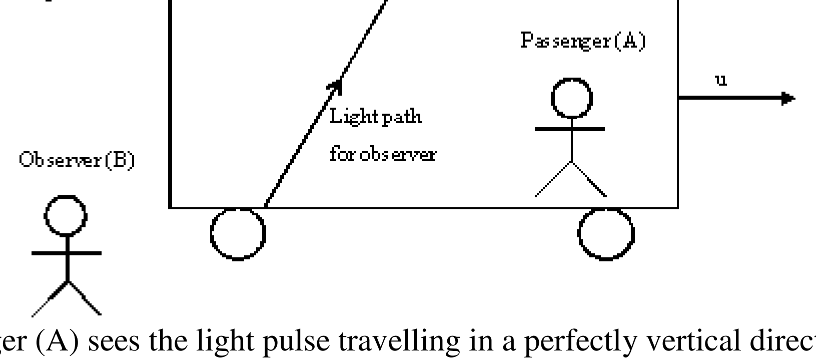
Why is mass not conserved when moving through different densities of space? If mass is simply a measure of the energy required to move an object through space, and an object of mass moves into a region of space where motion through this space requires less energy, then naturally the mass would be less. In this situation mass may not be conserved, but the strength of the "mass energy" field being emitted by an object is conserved. Thus "mass energy" is conserved, however mass is not.

How does gravitational acceleration work? Let's consider Figure 3 again and think about what would happen if there was more space on one side of an object of mass than the other. Every action force has an equal and opposite reaction force, so while mass pushes on space, space also pushes on mass. If space on either side of an object of mass was unbalanced, one could therefore expect that the side with more space would push the object of mass towards a region where there is less space. Thus objects of mass would be pushed by unbalanced space towards less dense regions of space, i.e. objects of mass would be pushed by the force known as "gravity" from weaker gravitational fields towards stronger gravitational fields. Gravity has long been considered a weak force, and it has also been shown that a large amount of energy is required to make a small amount of mass. The weakness of gravity can now be understood, consider the amount of energy that must be required to warp space, and consider also that gravity is the effect of unbalanced space on either side of an object of mass, then it is little wonder that so much energy is required to create the mass which is required to make so little gravitational force. In the context of my theory, gravity does not seem so weak after all, but is the effect of an energy field that warps the fabric of space itself!

Part 2c: Space And Electromagnetic Radiation

It has long been assumed that the constancy of light is explained by the Lorentz transforms, however this may not be the case. Let's consider one of Einstein's thought experiments, commonly found in textbooks, the thought experiment involving a light pulse on a train moving close to the speed of light. [Figure 4a]

Figure 4a



The passenger (A) sees the light pulse travelling in a perfectly vertical direction. The observer (B) sees the light pulse follow a diagonal path. Since the observer (B) experiences a longer time interval than the passenger whilst observing the light pulse cover a greater distance than the passenger (A), light speed appears constant for both passenger (A) and observer (B).

For simplicity of numbers I shall use a train travelling at a velocity 'u' of 3/5 of the speed of light. Using the Lorentz transforms, the mathematics are as follows. [The subscript 'A' denotes time and distance as measured by the passenger, no subscript denotes time and distance as measured by the relatively stationary observer.]

$$\frac{\Delta t}{\Delta t_A} = \frac{1}{\sqrt{1 - \frac{u^2}{c^2}}}$$

$$\frac{\Delta t}{\Delta t_A} = \frac{5}{4} s/s_A$$

The speed of light for the passenger is given by

$$c_A = 3.0 \times 10^8 \, m/s_A$$

A conversion of units yields

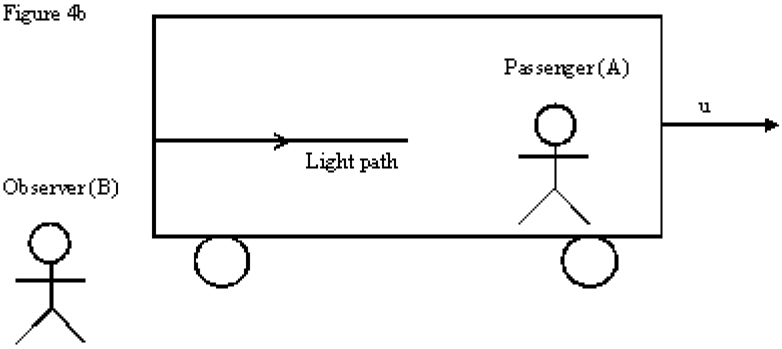
$$c_A = \left(\frac{4}{5}\right) 3.0 \times 10^8 \, m/s$$

Adding vertical velocity of light to horizontal velocity of the train by Pythagoras yields

$$\sqrt{c_A^2 + u^2} = \left(\sqrt{\frac{25}{25}}\right) 3.0 \times 10^8 \, m/s = 3.0 \times 10^8 \, m/s$$

Therefore the light pulse appears to travel at a constant 3×10^8m/s for both the passenger (A) and the relatively stationary observer (B). While this thought experiment is very commonly found in textbooks, the mathematics does not work when the light pulse is travelling in any direction other than the vertical (from the perspective of the passenger (A)). [Figure 4b]

Figure 4b



In the next example, as shown in the diagram above, both the passenger (A) and the relatively stationary observer (B) see the light pulse travel in the same direction as the train. For simplicity of numbers I shall again use a train travelling at a velocity 'u' of 3/5 of the speed of light. For this example length 'l' dilation also needs to be taken into consideration.

$$\frac{\Delta t}{\Delta t_A} = \frac{5}{4} s/s_A$$

$$\frac{l}{l_A} = \frac{4}{5} m/m_A$$

The speed of light for the passenger on the train is again given by

$$c_A = 3.0 \times 10^8\, m_A/s_A$$

A conversion of units yields

$$c_A = \left(\frac{4}{5}\right)\left(\frac{4}{5}\right)(3.0 \times 10^8)\, m/s = \left(\frac{16}{25}\right) 3.0 \times 10^8\, m/s$$

Adding velocity of light to velocity of train gives

$$c_A + u_A = \left(\frac{16}{25}\right) 3.0 \times 10^8\, m/s + \left(\frac{3}{5}\right) 3.0 \times 10^8\, m/s = \left(\frac{31}{25}\right) 3.0 \times 10^8\, m/s$$

Which is > $3.0\text{x}10^8$m/s and, skipping the calculations, if the pulse of light travels in the opposite direction to the train then the speed of the light pulse for the outside observer (B) is

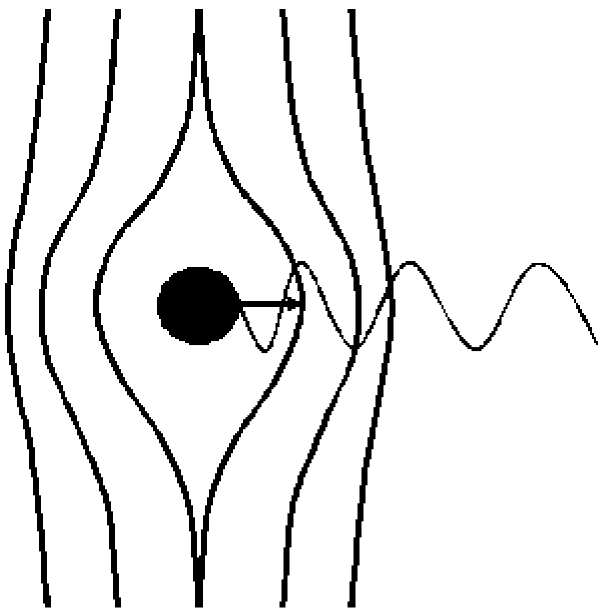
$$c_A - u_A = \left(\frac{1}{25}\right) 3.0 \times 10^8\, m/s$$

Which is < $3.0\text{x}10^8$m/s.

Put simply, the Lorentz transforms do not explain the constancy of light.

As explained earlier, when an object of mass is in motion, space would effectively move with that object of mass. Let's consider the effect this moving space would have on electromagnetic radiation approaching an object of mass in motion. If the medium that electromagnetic radiation travels through is space and the space that the electromagnetic radiation is moving through is in motion, then surely light would change its velocity depending on the velocity of the space it is travelling through. This should explain how red/blue shifts work, the idea is simple, light waves are either "stretched" or "squashed" due to the motion of space. [Figure 5]

Figure 5



Red/Blue shifts are one situation in which traditional physics ignores the first law of thermodynamics, but by this model the first law of thermodynamics is always obeyed. Although the wavelength of light changes when red/blue shifts occur, the velocity of light also changes. If $c_E=\lambda\upsilon_E$ and the speed of light (c_E) changes due to the motion of space, then the wavelength (λ) would change proportionally, leaving the frequency (υ_E) and therefore the energy of light constant.

Back to the problem of a light pulse on a train travelling close to the speed of light, according to my theory since light travels through moving space, there is no reason why light cannot travel faster or slower than $3x10^8$m/s from the perspective of an outside observer. According to my theory space is not nothing, space consists of a theoretical infinite number of planes of what Einstein would call "space-time" through which all matter and energy must travel. The important thing is that while light may change velocity depending on the velocity of space it is travelling through, the outside observer could never know this. The outside observer could not actually see the light pulse inside the train, unless that light was transmitted out through the window of the train and into his eyes. Once the light left the train to be seen by the outside observer that light would then be travelling through the space surrounding the outside observer and no longer travelling through the space of the fast moving train. The speed of light appears constant to all observers in all inertial reference frames, but this does not necessarily mean that the speed of light is always constant, only that light speed appears constant.

Part 3a: Back to Three Dimensions

It was Einstein who proposed the idea of theoretical planes of space warping to create gravity, and I have extended upon this idea in the preceding section. However, are planes of space actually necessary? In all of my diagrams of the warping of space I have used simply lines, since I have drawn a two-dimensional cross-section of these planes. Thus we find that rather than a theoretical infinite number of planes of space we can use a theoretical infinite number of lines, or "strings" instead and achieve the same result. We have now stripped away an extra unnecessary dimension and we are left with a three-dimensional picture of gravity, which is much more satisfactory. The fact that this picture of gravity is based around strings makes it all the more satisfying.

Part 3: Black Holes, The Big Bang And The Super-Universe

Part 3a: Black Holes

Recall from Part 1c that it is not the laws of physics which break down within the Schwarzschild radius, rather it is Einstein's equations which collapse, the laws of physics remain the same. The first thing I would like to talk about is the very existence of singularities. According to my theory, as gravitational field strength increases time becomes slower, and when time is slower everything moves less easily through space. So what would happen to a star as it collapses to form a black hole? As the star collapses and as the centre becomes more and more dense, time would slow more and more. Although theoretically a singularity could become infinitely dense, in practise time would slow infinitely and it would literally take *forever* for a singularity to become infinitely dense and infinitely small. I will therefore be calling the mass at the centre of a black hole a "black star" rather than a singularity.

Black holes are known sources of x-rays, in light of my theory there exists the possibility that these x-rays actually began as gamma-rays created by the destruction of matter upon entering a black hole. According to my theory light does not accelerate or decelerate due to gravity but the momentum of light can be changed causing the light path to change direction. Therefore if a gamma-ray was created somewhere within the Schwartschild radius of a black hole and that gamma-ray was travelling perpendicularly away from the centre of mass of the black star at the centre, there is no reason that gamma-ray could not escape with a greatly increased wavelength. However if a gamma-ray left at a large enough angle with respect to the centre of mass of the black star, that gamma-ray would have its path bent sufficiently for it to enter the black star, i.e. it would be unable to escape the black hole.

The final question with regards to black holes, is why would x-rays leave black holes concentrated in jets at the poles? The very simple reason is that due to the conservation of angular momentum as a black star becomes smaller and smaller, the rotational velocity of the black star would be so great as to have its observed mass increase about the equator, since mass increases with velocity close to light speed by the Lorentz transforms. Therefore the margin of error for a gamma-ray to leave a black hole perpendicular to the centre of mass of a black star would be much smaller about the equator, it would be much easier for electromagnetic radiation to leave a black star at the poles, since the observed mass is much less at the poles.

Part 3b: Einstein and the Infinite Universe

In the theory of General Relativity, Einstein confronts the gravitational problems associated with an infinite universe and presents a solution. In his words [Reference 1: Section 30]

"If we ponder over the question as to how the universe, considered as a whole, is to be regarded, the first answer that suggests itself to us is surely this: As regards space (and time) the universe is infinite. There are stars everywhere, so that the density of matter, although very variable in detail, is nevertheless on the average everywhere the same.

…

This view is not in harmony with the theory of Newton. The latter theory rather requires that the universe should have a kind of centre in which the density of stars is a maximum, and that as we proceed outwards from the centre of this group-density of the stars should diminish, until finally, at great distances, it is succeeded by an infinite region of emptiness. The stellar universe ought to be a finite island in the infinite ocean of space.

This conception in itself is not very satisfactory. It is still less satisfactory because it leads to the result that the light emitted by the stars and also individual stars of the stellar system are perpetually passing out into infinite space, never to return, and without ever again coming into interaction with other objects of nature. Such a finite material universe would be destined to become gradually but systematically impoverished."

Einstein then proceeds to describe 'The Possibility of a "Finite" and yet "Unbounded" Universe' [Reference 1: Section 31] as a solution to the gravitational problems associated with an infinite universe.

"It follows from what has been said, that closed spaces without limits are conceivable. From amongst these, the spherical space (and the elliptical) excels in its simplicity, since all points on it are equivalent. As a result of this discussion, a most interesting question arises for astronomers and physicists, and that is whether the universe in which we live is infinite, or whether it is finite in the manner of the spherical universe. Our experience is far from being sufficient to enable us to answer this question. But the general theory of relativity permits of our answering it with a moderate degree of certainty, and in this connection the difficulty mentioned in Section 30 finds its solution."

Einstein argues the case well for an infinite universe, however he understands that matter could not exist in an infinite universe with an average density due to the problem of infinite gravity creating gravitational chaos. Einstein then proposes a solution to the problem while still keeping the idea of a universe without boundaries. Just as a sphere is a three-dimensional circle, Einstein suggests that the universe may be a four-dimensional circle (or sphere if you prefer), such that were we to travel in one direction long enough we would eventually return to where we had started. Einstein invented the idea of a finite but unbounded universe not based on scientific evidence, but based on his belief that there was no other way. There is another way, I call it the "super-universe."

Part 3c: The Big Bang

In Part 3a I talked about black holes, let us now consider what would happen if a black hole was so massive that gamma-rays could not even escape at the poles. The internal energy of such a massive black star would surely increase as more matter is destroyed upon approaching the black star at the centre of the black hole. What happens when energy is added to a liquid? The internal energy of the liquid increases until a critical value is reached, the intermolecular forces binding the liquid together are overcome, and the liquid evaporates. Could the same thing have happened with the big bang? The early universe, in the time immediately following the big bang, was estimated to have a temperature in excess of 10^{30}K. Could this extremely high temperature be an approximate boiling point of a universe sized black hole?

If this is the case, and my theory of time and gravity is correct, then the universe would have initially expanded at a much slower rate due to the massive gravitational field surrounding it, and as time became faster the universe would have accelerated in its expansion as the speed of time increases, similarly to the inflationary early universe model.

Due to my theory of gravitational time dilation it is virtually inevitable that the universe will eventually collapse due to gravity, ending in what is known as the "big crunch". This is because, although the universe accelerates as it expands and gravitational field strength within the universe decreases, velocity squared increases proportionally to gravitational acceleration back toward the centre of the universe. Therefore as mass approaches zero gravitational acceleration increases at a much greater rate than velocity, meaning that the universe will almost certainly end in a big crunch.

The logical conclusion is that once the universe collapses at the end of its life it will again form a universe sized black star. This universe sized black star would again destroy atoms as they approach, the internal energy of the black star will continue to increase, until finally boiling point is again reached and the universe begins again. The energy in the universe is constant, the first law of thermodynamics is always obeyed.

Part 3d: The Super-Universe

If space is infinite but the universe is finite, then surely there must be more of these "big bang universes" outside of our own. Imagine somehow looking at a scaled down map of infinite space, on this map of infinite space our universe wouldn't even appear, it would be an infinitely small speck in a vast field of nothingness. No matter how massive something is, when compared to the infinite it is as nothing. Einstein addressed the problems of an infinite universe with his finite but unbounded universe, however there is a simpler solution.

Imagine that our big bang universe is not all that there is, imagine if our universe were nothing more than the equivalent of a star in a bigger universe, let's call it "super-universe I". This super-universe I would be an unfathomably massive universe containing not merely galaxies and stars and planets, but containing entire systems of big bang universes and universe sized black stars. Now imagine that super-universe I also undergoes a similar cycle of boiling, expansion, contraction and boiling again just like our own big bang universe. Think again about our scaled down map of infinite space, no matter how massive this super-universe I is it is still as nothing when compared to the infinite. As super-massive as this super-universe I is it still would not appear on our map of infinite space. Now imagine that this super-universe I was nothing more than the equivalent of a star in a bigger universe, let's call it "super-universe II". This super-universe II contains not merely systems of galaxies, and stars and planets, nor does it merely contain systems of big bang universes and universe sized black stars, but this super-universe II contains entire systems of super-universe I's. This super-universe II also undergoes cycles of boiling, expansion, contraction and boiling again.

I needn't think I should continue explaining this hypothesis further, imagine that the infinite universe is essentially a living, breathing, regenerative entity with no beginning and no end. Imagine that infinite space consists of an infinite series of these super-universes within super-universes. Imagine that the infinite universe has always existed and will continue to exist forever in some form or another. Now our map of infinite space is finally filled.

Recall Einstein's quotes in Part 3b, in order to prevent gravitational chaos in an infinite universe the density of matter must decrease the further away from the centre of the universe you travel. This model of the infinite universe is the one feasible model of the infinite which obeys this requirement. While our big bang universe may have an average density of matter, once you leave our big bang universe the density of matter would drop massively. Super-universe I may have an average density of matter, but once you leave super-universe I the density of matter would again drop massively. Thus if we were to consider the centre of our big bang universe to be the centre of the infinite universe, then the further from the centre of the infinite universe you travel the less the average density of matter becomes. There is no need to invent a space-time which curves around on itself, Einstein's justification for the finite but unbounded universe is invalid.

There is further evidence, besides being the only feasible model for the infinite universe, rather than thinking of the universe as cyclical and regenerative let us now consider it from the perspective of the second law of thermodynamics.

From the perspective of the second law of thermodynamics, since the disorder of the universe must always increase, a collapsing universe would seem to defy the second law of thermodynamics. However, according to my theory the collapsing universe is not a closed system, while yes our big bang universe may collapse someday, our big bang universe is part of super-universe I. So if our big bang universe is collapsing, then super-universe I may still be in the expanding phase. If super-universe I is in the collapsing phase, then super-universe II may be in the expanding phase. Everything is a part of something bigger, and there is always something bigger in the expanding phase. Call it a loophole if you will, but being a part of something bigger is the only way that the collapsing universe can still obey the second law of thermodynamics.

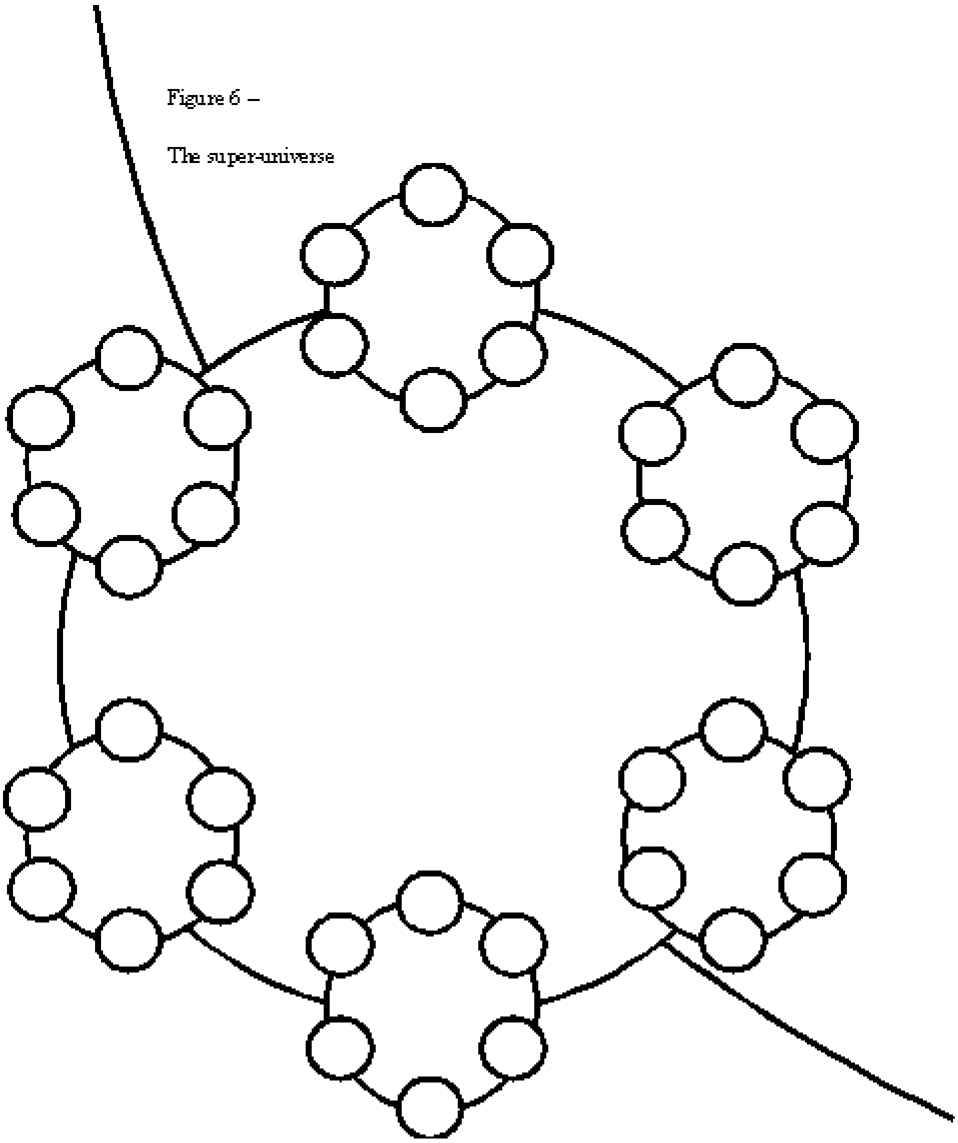
A popular philosophical question in physics is "why is gravity at just the right strength to support life?" The simple answer is that since our universe lies at the end of an infinite series of explosions, were gravity not the right strength to form galaxies and stars and planets, then there would have been a longer series of explosions. Big bang universes are only formed when gravity is at the required strength to form galaxies and stars and planets.

The theory of the super-universe is the only possible explanation for the origin and existence of the universe that obeys all the laws of physics.

"A perfect consistency can be nothing but an absolute truth" (Edgar Allan Poe, 'Eureka,' 1848)

Figure 6 –

The super-universe



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